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August 21, 1958

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Dear [redacted] 25X1

We have been working for two months now on the whistles and I am sending you this letter to indicate the status. Briefly, we have built four whistles which are all operable, but only one of which is completely equipped with a shutter mechanism for turning it on and off. We have made one flight test with a whistle but feel that further tests in the laboratory are necessary to establish the adjustments required for optimum operation of the whistle when it is in flight. These laboratory measurements we are now prepared to do but have not yet started them. Complete working drawings of the whistle have been made, as well as photos of some of the test set-ups.

Results of Preliminary Evaluation

A whistle was set up in the reverberation room and operated directly from the compressed air supply of the building. Under optimum conditions this whistle produced 400 watts of acoustic energy, at a frequency of approximately 950 cps. This was essentially a pure tone. A double tone having a shrill or piercing characteristic can also be obtained at about the same power level. To get an idea of how loud this is, a typical acoustic power output for a 500 horsepower single propeller airplane might be the order of 500 watts. The whistle output being pure tone is easily audible over the broad-band propeller noise. The whistle output is an order of magnitude greater than predicted in the proposal.

Since your principal concern will be the amount of sound emitted during flight, I will indicate the results we obtained on the flight test. A whistle was mounted on a Beech AT-11 twin engine airplane. The site of our operation was near [redacted] This location was used because we are operating there with some other experiments and it is in an area which is not too densely populated. A tape recorder for recording the signals was set up on the ground with a microphone. The airplane was flown in passes over the microphone at altitudes of 300 feet. The airplane approached at an angle of about 2° below horizontal and after passing over the site pulled out

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at an angle of approximately 2° above horizontal. In this way we were able to obtain velocities in the range of 190 to 220 mph as the plane passed overhead.

The recordings of the sounds emitted were brought back to the laboratory and we have made some analyses of them. The results were not as impressive as we had hoped they might be but, nevertheless, the whistle was definitely audible above the noise of the airplane propellers. The surprising part perhaps was that the whistle was much louder as the airplane went away from the observing site than it was as the airplane approached. In checking back over the observations, it appears that this might be accounted for by the relatively smaller velocity of the airplane on pull-out. In this case we observed that the airplane speed dropped to about 140 to 160 mph. The sound pressure level on the ground approached 100 db for the plane directly overhead. The level remained at between 80-90 db for the plane at a distance of a mile or so beyond the site. This was due, of course, to the better velocity range of the airplane. For a 300 mph plane it will be necessary to cut down the inlet area of the whistle so that the mass rate of airflow into the whistle will be optimum.

Experiments we are now setting up will permit us to vary the air velocity over a greater range than could be accomplished in our reverberation room. As a source of air we are using a large centrifugal blower exhaust fan which will provide an air stream of nine inches cross-section at velocities up to about 180 mph. While the acoustic environment in the room for this fan is not as ideal as our reverberation room it, nevertheless, will provide satisfactory indications of the sound generated by the whistle. The measurements can then be correlated with the reverberation room data which we have already obtained. It is expected that the range of velocity variation available will enable us to extrapolate to the 300 mph velocity needed.

As I indicated, there are still some measurements that ought to be made to furnish you with the operating parameters of the whistle. Accordingly, a proposal for making these measurements is attached.

Respectfully submitted,

[redacted] 25X1

APPROVED:

[redacted] 25X1

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PROPOSAL ON EVALUATION OF FOUR WHISTLES

Four whistles have been built which generate high sound levels. These whistles are to be attached to an aircraft flying at velocities in the neighborhood of 300 mph. Preliminary production tests indicate that the whistles will perform as designed. Evaluation is needed to establish the range of satisfactory operation and to enable us to recommend to the user the correct procedures for installation and use.

The program suggested will involve making final laboratory measurements of the relationships between air velocity (airplane speed) and optimum output. From this, refinements will be made in the whistle structure. Having incorporated these refinements, the whistle is to be flown over our site to make a final determination of the sound generated.

To accomplish this evaluation and to make modifications as may be found necessary, it is estimated that three months time will be required. It is estimated that the cost will be as follows:

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Total Estimated Cost **$ 6,572.**